

WO 2004/092771 A3

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property
Organization
International Bureau



(43) International Publication Date
28 October 2004 (28.10.2004)

PCT

(10) International Publication Number
WO 2004/092771 A3

(51) International Patent Classification⁷:**G01V 1/38**

(74) Agent: SUCKLING, Andrew; Marks & Clerk, 4220 Nash Court, Oxford Business Park South, Oxford Oxfordshire OX4 2RU (GB).

(21) International Application Number:

PCT/EP2004/050527

(22) International Filing Date: 15 April 2004 (15.04.2004)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

0308632.9 15 April 2003 (15.04.2003) GB

(71) Applicant (for AE, AG, AL, AM, AT, AU, AZ, BA, BB, BE, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, SZ, TJ, TM, TN, TR, TT, TZ, UA, UG, UZ, VC, VN, YU, ZA, ZM, ZW only): **WESTERNGEICO SEISMIC HOLDINGS LIMITED**; Citco Building, PO Box 662, Roadtown, Tortola (VG).

(71) Applicant (for FR only): **SERVICES PETROLIERS SCHLUMBERGER [FR/FR]**; 42, rue Saint Dominique, F-75007 Paris (FR).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **HOWLID, Martin** [NO/NO]; Asta Hanssens vei 106, N-1341 Slependen (NO). **SINGH, Rohitashva** [IN/NO]; Damstredet 2, N-0177 Oslo (NO).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

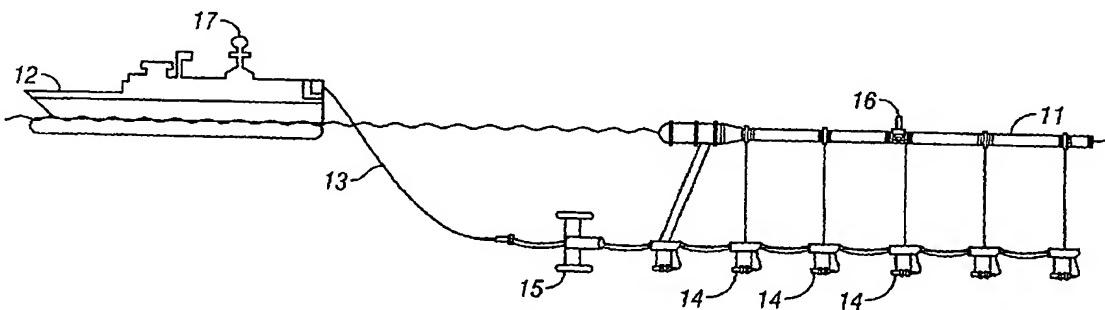
Published:

— with international search report

(88) Date of publication of the international search report:
31 March 2005

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: ACTIVE STEERING FOR MARINE SEISMIC SOURCES



(57) Abstract: A seismic survey system having a source array (11) coupled to a deflector device (15) that controls the position of the source array. A positioning system unit (16) is mounted on the source array to provide a signal to a controller, informing the controller of the current position of the source array so that the controller can control the position of the deflector device (15) and the coupled source array. A seismic source (14) on the source array may be triggered when the source array is at a desired location as measured by the positioning system unit. The deflector device (15) comprises one or more wings (18) in a generally vertical or, alternatively, in a generally horizontal arrangement disposed adjacent to a central body (19). The streamlined central body has connection points that allow the deflector device (15) to be connected to a tow cable (13) from the tow vessel (12) and to the source array (11).

INTERNATIONAL SEARCH REPORT

International Application No
PCT/EP2004/050527

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 G01V1/38

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 G01V

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 018 053 A (SHELL INT RESEARCH) 29 October 1980 (1980-10-29)	1-6,8, 12, 14-16, 18,19, 26, 32-37, 41, 43-45, 52, 58-60,62 7,9-11, 13, 38-40, 42,61
Y	abstract; figures 1-4,6 page 2, line 12 - line 18 page 10, line 27 - page 11, line 14 ----- -/-	

Further documents are listed in the continuation of box C.

Patent family members are listed in annex.

° Special categories of cited documents :

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the International filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the International filing date but later than the priority date claimed

- "T" later document published after the International filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- "&" document member of the same patent family

Date of the actual completion of the International search 12 October 2004	Date of mailing of the international search report 04.01.2005
Name and mailing address of the ISA European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax (+31-70) 340-3016	Authorized officer De Bekker, R

INTERNATIONAL SEARCH REPORT

International Application No
PCT/EP2004/050527

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	WO 01/61380 A (SCHLUMBERGER CA LTD ; SCHLUMBERGER SERVICES PETROL (FR); LINDTJORN OLA) 23 August 2001 (2001-08-23) page 6, line 8 - line 9 page 7, line 22 - page 8, line 13 -----	7,9-11, 13, 38-40, 42,61
X	US 4 748 599 A (GJESTRUM EINAR ET AL) 31 May 1988 (1988-05-31) abstract; figures 1-4 column 2, line 8 - line 19 -----	1,4,26
X	US 4 323 989 A (HUCKABEE KERMIT D ET AL) 6 April 1982 (1982-04-06) abstract; figures 1-3,7 column 3, line 51 - line 54 column 5, line 13 - line 33 -----	1,2,4,26
X	EP 0 168 959 A (TEXAS INSTRUMENTS INC) 22 January 1986 (1986-01-22) abstract; figures 1,4,5 page 4, line 18 - line 23 -----	1,4-6
X	US 4 845 686 A (BRAC JEAN) 4 July 1989 (1989-07-04) abstract; figure 1 column 4, line 29 - line 38 -----	1,2,5,6
X	US 6 011 753 A (CHIEN LORING C) 4 January 2000 (2000-01-04) abstract; figure 1 column 3, line 3 - line 15 -----	1,5,6,8, 26

INTERNATIONAL SEARCH REPORT

International application No.
PCT/EP2004/050527

Box II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. Claims Nos.: because they relate to subject matter not required to be searched by this Authority, namely:

2. Claims Nos.: because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:

3. Claims Nos.: because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.

2. As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:

4. No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

1-16, 18, 19, 26, 32-45, 52, 58-60, 61b, 62

Remark on Protest

- The additional search fees were accompanied by the applicant's protest.
- No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-16,18,19,26,32-45,52,58-60,61b,62

This first group of claims solves the objective problem of improving positioning information applicable to a seismic survey system and method which comprises: a source array; an independently steerable deflector device to control the position of the array; and a positioning system comprising a positioning unit mounted on the array to determine the location of the source array with a controller operationally connected to control the position of the deflector, by means of the special technical feature, as defined by the subject-matter of dependent claim 7, being the use of GPS positioning, thereby enabling more accurate 4D surveying.

2. claims: 17,20-24,46-50,61a,64a

This second group of claims solves the objective problem of improving the usability of the deflector in a seismic survey system and method which comprises, a source array; an independently steerable deflector device to control the position of the array; and a positioning system comprising a positioning unit mounted on the array to determine the location of the source array with a controller operationally connected to control the position of the deflector, by means of the special technical feature being technical details on the construction of the deflector, thereby improving depth control and buoyancy characteristics as well as endurance.

3. claims: 27-31,53-57

This third group of claims solves the objective problem of preventing damage due to floating debris applicable to a seismic survey system and method which comprises: a source array; an independently steerable deflector device to control the position of the array; and a positioning system comprising a positioning unit mounted on the array to determine the location of the source array with a controller operationally connected to control the position of the deflector, by means of the special technical feature being a forward looking acoustical transducer and receiver to enable obstruction detection and avoidance.

4. claims: 25,51,63,64b-79

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This fourth group of claims solves the objective problem of improving efficient adjusting of relative positioning of a plurality of source arrays in a seismic survey system without the otherwise necessary re-trimming of the available deflectors by means of the special technical feature being a winch attached to distance ropes mounted between the respective source arrays, thereby enabling adjustment of relative distances.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/EP2004/050527

Patent document cited in search report	Publication date	Patent family member(s)		Publication date
EP 0018053	A 29-10-1980	AU AU EP GB JP JP JP JP MY NO NZ	534900 B2 5767880 A 0018053 A1 2047406 A ,B 1474471 C 55144573 A 63021876 B 16185 A 801153 A ,B, 193503 A	23-02-1984 30-10-1980 29-10-1980 26-11-1980 18-01-1989 11-11-1980 09-05-1988 31-12-1985 27-10-1980 18-11-1983
WO 0161380	A 23-08-2001	AU CA GB WO NO	3045201 A 2400246 A1 2364388 A ,B 0161380 A2 20023744 A	27-08-2001 23-08-2001 23-01-2002 23-08-2001 17-10-2002
US 4748599	A 31-05-1988	NO DE FR GB	855143 A 3643363 A1 2591755 A1 2184413 A ,B	19-06-1987 03-09-1987 19-06-1987 24-06-1987
US 4323989	A 06-04-1982	NONE		
EP 0168959	A 22-01-1986	CA DE EP NO US	1241103 A1 3564410 D1 0168959 A1 852459 A ,B, 4719987 A	23-08-1988 22-09-1988 22-01-1986 20-12-1985 19-01-1988
US 4845686	A 04-07-1989	FR CA DE EP JP NO	2606158 A1 1278085 C 3773123 D1 0267840 A1 63116991 A 874514 A	06-05-1988 18-12-1990 24-10-1991 18-05-1988 21-05-1988 02-05-1988
US 6011753	A 04-01-2000	NONE		